RACIAL DIFFERENCES IN BREAST CANCER SCREENING, KNOWLEDGE AND COMPLIANCE

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Background: Breast cancer is the second leading cause of cancer death among women in the United States. Although the incidence of breast cancer is 13% higher in white women, mortality in black women is 28% higher, due to histological and socioeconomic factors. Existing research regarding racial differences in compliance with breast cancer screening recommendations has found conflicting results.

Methods: Data on more than 4,500 women were taken from the 1992 National Health Interview Survey, a nationally representative, population-based sample survey. Logistic regression was used to estimate the relative odds of knowledge of breast self-exam (BSE) and mammograms, and compliance with BSE, clinical breast exams (CBE), and mammograms.

Results: Black women were less likely than white women to be aware of and use breast cancer screening tests. However, among women who were aware of screening tests, compliance was higher among black women. Women with low educational attainment, low cancer knowledge, and no usual source of care were less likely to be CBE or mammogram compliant. Socioeconomic differences were larger for the two clinical tests than for BSE.

Conclusions: Programs should inform women about cancer screening tests and remove barriers that hinder women from receiving clinical screening exams. (*J Natl Med Assoc.* 2003;95:693–701.)

Key words: breast cancer ♦ knowledge, attitudes and practices ♦ mammograms ♦ mass screening ♦ socioeconomic factors

After lung cancer, breast cancer is the second leading cause of cancer death among women in the United States, causing 4.2% of all deaths in women. While the incidence of breast cancer is 13% higher in white women, mortality in black women is 28% higher, partly due to biological factors such as more aggressive histology and more treatment-resistant tumors.[2,3,4] Black women, on average, are also diagnosed at a more advanced cancer stage, which may be affected by access[5] and attitudes about health care seeking.[6] Engaging in breast cancer screening on a regular basis is a proactive way to reduce the risk of breast cancer mortality.

Findings on racial differences in breast cancer screening compliance vary in part due to differences in study populations and geographic location. Most past studies have utilized local area samples of black women, often from low income, inner-city areas,[7,8,9] health clinics[7,10] or non-generalizable convenience samples.[11,12,13,14] Retrospective studies may also be limited by differences in the accuracy of respondent recall of the frequency and timing of screening exams.[15] Research using clinical records to determine screening compliance has been relatively rare,[16,17,18] and such studies are limited by the fact that only women who receive care are represented.

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Different definitions of "compliance" may also account for discrepant findings across studies, reflecting the ongoing debate regarding guidelines for age and frequency of mammography. In recent years, compliance has been defined as a mammogram or clinical breast examination (CBE) within the past year,[8, 19, 20, 21] but sometimes includes screening intervals of up to three years.[22] Guidelines for mammograms and breast self-exam (BSE) vary depending on age, family and personal history.

Some studies show that white women are more likely than black women to be mammography[23, 24, 25, 26] and CBE compliant,[9] while others have found black women to be more compliant.[6, 27] More recent studies, however, have not found any racial differences in compliance with mammography screening recommendations.[28,29,30,31,32,33] Higher income[1,15,19] and education[7,15,19,25] have consistently been linked to increased compliance with mammography, and to a lesser extent for CBE.[19, 21] BSE is more commonly practiced among black women than white women.[10, 34, 35] Greater knowledge of breast cancer risk factors and guidelines is associated with higher compliance[36, 37, 38, 39]—although this finding has also been challenged[40, 41]—especially for BSE[39, 42, 43].

Cancer screening compliance has been demonstrated to be lower among individuals who are unaware of the benefits and means of performing or obtaining screening.[44, 45, 46, 47] Few studies have examined whether there are racial differences in breast cancer knowledge, although one important study found a lower awareness of breast cancer among African-American women.[39, 44] The three screening exams differ in their dependence on the formal health care sector. Breast self-exam requires only knowledge of the need for screening and how to perform BSE—information that is available without visiting a physician. Moreover, BSE can be done at home at the woman's convenience, unlike the other two screening exams. Clinical breast exams and mammograms require a clinical visit each time, often two in the case of a mammogram—the first for the CBE and prescription for a mammogram, the second for the mammogram to be taken. Time and financial costs associated with CBE and mammograms are hence much higher, particularly for women who lack health insurance, a problem that disproportionately affects black women.[48, 49, 50, 51]

In addition, compliance with CBE and mammography recommendations often require that these costs be incurred annually, whereas BSE remains free no matter how often it is performed. Nevertheless, because the tests are intended to be complementary to each other, it is recommended that women obtain all three screening exams at the specified intervals.

Source of health care also affects screening behavior. Women who use emergency rooms and public health clinics as their usual source of care would be expected to have worse compliance on the two clinical breast cancer screening tests, because they are less likely to have someone coordinating their care and advising them on preventive care.[51, 52] In 1996, about 16% of black women, compared with only 8% of white women, relied on hospital-based providers.[53]

This study examines racial differences in BSE, CBE and mammogram compliance, controlling for socioeconomic factors, knowledge and attitudes about cancer and cancer screening, and access to care. This study addresses the following three research questions: Do white and black women differ in their compliance with all three screening tests? Does socioeconomic status (SES) affect the likelihood of being screened by clinical tests? How do compliance patterns differ among women who are aware of the test?

This study extends current knowledge in several ways. First, separate analysis of the three screening tests will shed light on the relative importance of socioeconomic characteristics and attitudes versus access to care. Second, differences in awareness of screening tests and guidelines are examined as distinct from compliance that is conditional on knowledge. Third, use of a nationally representative sample eliminates variations in study design or sample as explanations for different findings, and provides enough statistical power to detect potential associations. Finally, the sensitivity of findings to varying definitions of compliance (e.g., frequency of screening) is examined.

METHODS

This study used the Cancer Control Supplement of the 1992 National Health Interview Survey, a cross-sectional survey of non-institutionalized U.S. citizens over age 18.[54] The NHIS is based on multistage probability sampling and is representative of the national population. Only women over 30 (and women over 40, for mammograms) were included in the sample, to match age guidelines for screening recommendations. Respondents for whom race or

ethnicity was unknown (0.7%) and women for whom compliance could not be measured for any of the three compliance modes (n=677; 9.7%) were also excluded. Hispanic women and those from other racial/ethnic groups were omitted, because there were too few in the NHIS to permit separate analysis. The final sample comprised 3,881 non-Hispanic white women and 708 non-Hispanic black women.

Women aged 30 and older were asked whether they had received a mammogram or clinical breast exam either in the past year, one to three years ago, or more than three years ago. Because the 1992 American Cancer Society guidelines suggested biennial mammogram screening for women starting in their forties and annually thereafter, compliance with mammography guidelines was defined as having had the test within the past three years. The guidelines also recommended a CBE exam every three years between ages 20 and 40 (annually thereafter), and monthly BSE for women 20 and older. Women were classified as CBE compliant if they had received a CBE exam within the past three years, and BSE compliance was defined as performing BSE at least nine times per year.

Women who answered affirmatively to the question, "Do you know how to examine your own breasts for lumps?" were considered to have "performance knowledge" of BSE.[55] Women 40 and older who had heard of mammograms were considered to be "aware of mammograms." To distinguish between knowledge of screening tests and screening behavior based on that knowledge, analyses regarding BSE compliance included only the 4,206 women who indicated that they knew BSE. For mammography compliance, only the 3,025 women 40 and older who had heard of mammograms were analyzed. For clinical breast exam, only women over 30 with valid CBE compliance measures were assessed (n=4,257).

Breast cancer risk factor knowledge was measured using the question: "Which of these things do you think increases a woman's chances of getting cancer of the breast: none of these, increasing age, high-fat diet, low-fiber diet, smoking, family history, having multiple sexual partners?" (Correct answers included increasing age, high-fat diet, smoking, family history). Knowledge of screening guidelines was assessed by asking what age doctors recommend to begin having mammograms and CBE.

Summary measures of the total number of correct risk factors and age guidelines for both screens were calculated. Incorrect answers were not includ-

Table 1. Knowledge of and Compliance with Breast Cancer Screening Tests (%),† by Race 1992 NHIS Cancer Control Supplement

	White (n=3,881)	Black (n=708)	Total (n=4,589)	χ^2 (p-value)
Breast self-exams (BSE)				
Know BSE (n=4206)	92.6	88.2	92.1	9.78 (p<.001)
BSE compliant‡				
% of all women	41.8	33.9	40.8	9.94 (p<.001)
% of women who know BSE	62.9	75.0	64.3	22.70 (p<.001)
Clinical breast exams (CBE)				
CBE compliant§	83.3	88.5	84.4	7.39 (p<.05)
Mammograms				
Heard of mammograms (n=3025)	94.2	91.6	94.0	3.14 (p=.08)
Mammogram compliant‖				
% of all women	62.2	59.8	61.9	0.69 (p=.41)
% who heard of mammograms	66.5	66.7	66.6	0.01 (p=.94)

Table 1: † Percentages are weighted to population level using sample weights provided by the 1992 National Health Interview Survey. Standard errors for chi-square tests are corrected for complex sampling design using SUDAAN.

‡ BSE compliant = performed BSE at least nine times in past year.

§ Among women 30 and older with valid compliance measures (n=4257)

‖ Mammogram compliant = mammogram in the past three years

Table 2. Estimated Odds Ratios of Breast Cancer Screening Knowledge and Compliance[†] 1992 NHIS Cancer Control Supplement

	Breast Self-Exam		Clinical Breast Exam compliant[‡]	Mammography	
	Know BSE	*BSE compliant[‡]*		*Heard of Mammograms[§]*	*Mammography compliant?*
RACE					
White	1.00	1.00	1.00	1.00	1.00
Black	0.80	1.73***	1.89***	1.12	1.35*
AGE					
30–39 years old	2.33***	0.75*	1.60***	N/A	N/A
40–49 years old	2.16***	0.76	1.27	1.14	0.59***
50–59 years old	2.06***	0.97	1.47	2.37***	0.99
60–69 years old	1.83***	0.86	1.51*	2.19***	1.12
30+ years old	1.00	1.00	1.00	1.00	1.00
ECONOMIC STATUS					
Income					
$0–$14,999	1.00	1.00	1.00	1.00	1.00
$15,000–$24,999	1.21	0.95	0.91	1.16	0.52
$25,000–$49,999	1.01	1.18	1.24	2.04	0.65
$50,000+	0.95	1.10	1.08	1.12	1.02
Education					
Less than high school	1.00	1.00	1.00	1.00	1.00
High school graduate	1.45	0.90	0.99	3.35***	1.29*
Some college	1.61	1.02	1.34	3.93***	1.46*
College and beyond	1.81*	0.81	2.28***	1.85	2.44***
Usual source of care					
Doctor's office	2.04***	1.04	3.48***	3.01***	2.91***
Emergency room	1.11	1.19	2.17	1.58*	3.15*
Hospital outpatient	1.85	1.15	5.00***	2.55***	3.35***
Health center/HMO	3.09***	0.85	4.37***	3.18***	4.01***
Public health clinic	2.48	1.37	2.46*	1.40	2.57*
No usual source of care	1.00	1.00	1.00	1.00	1.00
KNOWLEDGE					
Risk factor score					
No risk factors correct	1.00	1.00	1.00	1.00	1.00
1–2 risk factors correct	1.69***	0.88	1.35*	1.30	1.67***
3–4 risk factors correct	1.72*	0.82	1.99***	2.48*	2.29***
Guideline score					
0 guidelines correct	1.00	1.00	1.00	1.00	1.00
1 guideline correct	2.57***	1.12	1.51***	N/A	1.69***
2 guidelines correct	1.76	0.83	2.36***	N/A	1.95***
ATTITUDES					
Fatalism					
Not fatalistic	1.00	1.00	1.00	1.00	1.00
Fatalistic	0.42*	1.58	2.70	0.56	0.73
Self-reported health status					
Excellent/Very Good	1.00	1.00	1.00	1.00	1.00
Good	0.77	0.93	0.88	1.24	0.93
Fair	0.73	1.17	0.83	1.01	1.04
Poor	0.48*	1.14	0.89	1.07	0.90
How much progress made?					
A great deal	1.00	1.00	1.00	1.00	1.00
Some	0.94	1.13	1.13	0.92	1.00
Very little/None	1.08	0.95	0.81	0.51*	0.75
Depends on cancer type	1.60	0.86	0.92	0.40***	0.86

Table 2: † Mammography and CBE compliance are measured as having had the exam within the past three years. BSE compliance is measured as having performed BSE nine times or more a year
‡ Among women who had heard of breast self-exam (n=4,206)
§ Among women 40+ (n=3,243);
ǂ Among women 40+ who had heard of mammograms (n=3,025);
*: p<.05; **: p<.01; ***: p<.001

ed in the index and did not subtract from the composite score. For risk factors, women were categorized into: 0, 1–2, or 3–4 correct risk factors. Screening guideline knowledge was measured on a continuous scale from 0 to 2. "Non-fatalistic" attitudes were defined as believing one's chances of surviving breast cancer were excellent, very good, or good; "fatalistic" comprised belief of fair or poor survival chances. Opinions on the progress being made against cancer and self-reported health status were other attitudinal measures.

Statistical significance of bivariate associations was tested using the chi-square statistic. Logistic regression was used to analyze knowledge of and compliance with each of the breast cancer screening tests, controlling for socioeconomic variables, and knowledge and attitudes about breast cancer and screening.

For the dependent variables of breast cancer awareness and compliance, "1" was used to designate women who were aware of the screening test or who were compliant with the test, while women who were unaware or non-compliant were coded as "0." The models were also conducted using a stricter measure of compliance (e.g., within the past year) to test the sensitivity of the findings to varying definitions of compliance.

The data were weighted to the population level using sample weights provided by the NHIS Cancer Control Supplement.[54] Standard errors were corrected for the complex study design using SUDAAN software.[56]

RESULTS

Bivariate Findings

White women were more likely to report knowing how to perform breast self-exams (93% versus 88% for black women; p<0.001), and more likely to be BSE compliant (42% versus 34%; p<0.001). However, among women who know BSE, black women were significantly more compliant than their white counterparts (75% versus 63%; p<0.001, see Table 1). Black women were slightly more compliant than white women with clinical breast exams (89% versus 84%; p<0.05). Both races were equally likely to be aware of mammograms and to be compliant with mammography screening within the past three years, whether the analysis included all women or was limited only to those who had heard of mammograms.

More white women than black women were college educated (19.7% versus 13.6% for black women; p<0.001, not shown) and earn $50,000 or more (29.1% versus 19.9%; p<0.001, not shown). White women were also more likely to use a doctor's office as their usual source of care (73% versus 58%; p<0.001, not shown), while black women showed more reliance on hospital emergency rooms, outpatient clinics, and HMOs.

Multivariate Findings

Table 2 presents results of logistic regression models of screening knowledge and compliance. When the effects of socioeconomic characteristics, risk factor and screening guidelines, and attitudes were taken into account, white and black women were equally likely to be aware of BSE and of mammograms. When analyses of screening behavior were restricted to women who were aware of the pertinent screening test, black women had nearly twice the odds of being BSE compliant as their white counterparts (OR=1.73; 95% CI: 1.31, 2.27; p<0.001), and slightly higher odds of being mammogram compliant than whites (OR=1.35; 95% CI: 1.02, 1.79; p<0.05). Black women had almost twice the odds of being CBE compliant as white women (OR=1.89, 95% CI: 1.29, 2.75; p<0.001).

Awareness and compliance with the two clinical screens increased substantially with educational attainment, but BSE compliance did not vary by educational attainment. Education was particularly important in mammogram awareness and compliance; women with a high school degree (OR=3.35; 95% CI: 2.21, 5.08; p<.001) or some college education (OR=3.93: 95%CI: 2.03–7.62) had more than three times the odds of having heard of mammograms as women who did not finish high school.

However, women with at least a college education had similar odds of having heard of mammograms as women with less than a high school education (OR=1.85; 95% CI: 0.93, 3.66). Income, which was positively related to screening knowledge and behavior in bivariate tests (not shown), was no longer a significant predictor in the multivariate models.

BSE knowledge was lowest in the oldest age groups, while mammogram awareness and CBE compliance were highest among older women. However, among women who knew BSE and were aware of mammograms, compliance was worse among younger than older women.

With the exception of BSE compliance, source of usual care remained significant for all screening outcomes. In general, using a doctor's office, hospital outpatient clinic, or HMO increased screening awareness and compliance at least twofold, compared to those who had no usual source of care. Again, this relationship was especially strong for clinical-dependent screens (mammograms and CBE). Using a public health clinic was found to be associated with higher CBE and mammogram compliance.

Women who could name most risk factors and guidelines were much more likely to be screening knowledgeable and compliant, particularly for mammography. Risk factor and guideline knowledge were not significant predictors of BSE awareness or BSE compliance when SES and attitudes were taken into account.

Further analysis with a stricter definition of compliance was conducted for each of the three measures: having had a mammogram or CBE within the past year, and performing BSE at least 12 times a year, using the same age restrictions for each screen. With the stricter compliance measures, no racial differences were found in CBE and mammography screening, although black women were still more compliant with BSE screening (OR=1.71; $p<0.001$, not shown).

DISCUSSION

In models that take into account a wide range of sociodemographic characteristics, knowledge and attitudes about breast cancer, black women were more likely than white women to be compliant with each of the three breast cancer screening behaviors within the past three years. Awareness of the test and how to perform it accounted for substantial portions of the variation in screening compliance. When all women were considered, 40% of white women but only one-third of black women complied with breast self-exam guidelines.

However, the picture is completely reversed when compliance patterns are studied only among those who know of the test. Among those who report knowing BSE, three-quarters of black women but less than two-thirds of white women were BSE compliant. The racial difference in mammogram compliance is also explained in part by awareness, with lower awareness of mammograms among blacks but comparable screening rates in both racial groups among those who were aware of mammograms.

This finding suggests that screening behavior should be treated as occurring in two distinct steps: First, being aware of the test and its associated guidelines, and second, complying with the test once aware of it. The first is a question of imparting knowledge, whereas the second is affected by attitudes and access to care, particularly in the case of screening tests that involve one or more visits to the doctor.

We found a strong association of knowledge of cancer risk factors and screening guidelines with both clinical breast exam and mammography compliance. These findings are consistent with past research[4, 8, 10, 11, 42] and suggest the need for appropriate educational interventions for populations at risk for low cancer knowledge. When socioeconomic factors, usual source of care, and cancer knowledge were taken into account, attitudes about cancer were not related to any of the screening measures except self-reported BSE knowledge. However, this analysis was limited to a single question about attitudes available in the NHIS. Future studies should re-examine the issue with additional measures of the wide range of beliefs that comprise fatalism attitudes regarding cancer.[30, 57, 58]

Of great concern are the marked deficits in CBE compliance, mammogram knowledge, and mammogram compliance among less-educated women and those without a usual source of care, because CBE and especially mammograms are better than BSE for detecting suspicious breast lumps. Women with at least a high school degree were more likely than their less-educated peers to have heard of mammograms. Among those who had heard of mammograms, chances of mammogram compliance increased with each educational level, with a two-and-a-half-fold difference between those who had not graduated from high school compared to those who had completed college or more. Differences across educational attainment groups

in BSE performance knowledge and CBE compliance were far smaller but of concern nonetheless. In striking contrast, BSE compliance was unrelated to socioeconomic status, usual source of care, or cancer knowledge, possibly because BSE is a procedure that any woman can perform, regardless of education, income, or access to health care.

Having any usual source of care was associated with much higher rates of BSE knowledge, CBE compliance, and both mammogram knowledge and compliance. For example, women in HMOs had over three times the odds of mammogram awareness and four times the odds of mammogram compliance as those with no usual source of care. Physician recommendation for mammograms is a powerful motivator for mammogram compliance,[59] and such recommendations are less common for black women,[60, 61] and women without a usual source of care.

When educational attainment and usual source of care were taken into account, income was not significantly related to any of the screening outcomes. More educated women often obtain higher paying jobs with health insurance coverage. In 1999, blacks were almost twice as likely as whites to be uninsured (23% versus 12%) and considerably less likely to have private insurance (65% versus 85%)[62]. The NHIS lacked a direct measure of insurance status and type. Future studies should ideally include a measure of insurance status to address this important limitation, because insurance has been shown to affect care-seeking behavior and provider attitudes and medical decision-making.[63]

Another limitation of this data is the coarse gradations in recency of screening that were available to assess compliance. With the categories available on the NHIS questionnaire, it is impossible to differentiate between women who barely missed screening guidelines and those who received a mammogram two years and 11 months ago.

We found different conclusions about racial differences in screening behavior depending on the time interval used to measure compliance. Blacks were more compliant than whites when a three-year screening interval is used to define compliance, but there was no racial difference in CBE and mammography when compliance is defined as within the past year. In addition, questions should be worded to allow differentiation between simple awareness of screening tests and mastery of information about how and how frequently to conduct or obtain each breast cancer screening test.

Because the survey questionnaire was only administered to women 30 and older, we were unable to assess compliance with BSE and CBE of women in their twenties. Furthermore, these data cannot be used to assess biennial screening—a recent recommendation of some cancer organizations. Recent versions of the NHIS use more specific recording of time since last examination, and this type of measurement should continue. Future research should also utilize medical records of screening practices, which would reduce potential errors in recall noted in past literature,[64] and it would allow creation of different definitions of compliance, which varies from year to year and across different organizations. A concerted effort should also be made within the various professional cancer organizations to create consistent screening recommendations.

ACKNOWLEDGEMENTS

Susan Brownlee, Linda Patrick-Miller, and three anonymous reviewers provided valuable comments on earlier drafts. The authors also would like to thank the Rutgers University Undergraduate Research Fellows Program for partial support for this work.

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